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AUTHOR	Smith, Patricia; Henderson, Cathy
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ABSTRACT

A taxonomy of all institutions of higher education was developed as a tool for analyzing the patterns of current revenues and expenditures. The goal was to examine institutional patterns simultaneously, examining them for the characteristics that have the greatest influence in distinguishing institutions from each other and then grouping institutions according to these characteristics. Among the findings are that: (1) private institutions revealed greater variation in financial profiles than public institutions; (2) that 32 groups of institutions fall into five clusters, each dominated by one funding source (tuition, endowment income, annual private giving, sponsored research revenues, and state and local appropriations); and (3) on a "per FTE-student" basis, federal student-aid grant revenues constituted 37 percent of the total student-aid revenues of the private institutions in 1972-73, while in public institutions it represented 57 percent of the total.

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A FINANCIAL TAXONOMY OF INSTITUTIONS OF HIGHER EDUCATION

Patricia Smith

Cathy Henderson

Policy Analysis Service

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April 1976

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This report was done as one part of a study of the private sector of higher education, carried out under USOE CONTRACT 300-75-0375.

HIGHLIGHTS

- Private institutions revealed greater variation in financial profiles than public institutions. The computer analysis which grouped institutions according to their similarities distributed private institutions among 21 of the total 32 groups, and public institutions were concentrated in seven groups. Four groups were "mixed". Because of the diversity of the financial profiles of private institutions, no specific public policy will have uniform impact.

- The 32 groups of institutions of higher education fall into five clusters, each dominated by one of the following revenue sources: (1) tuition, (2) endowment income, (3) annual private giving, (4) sponsored research revenues/expenditures, (5) state and local appropriations.

- Approximately 90% of private institutions and 94% of small private liberal arts colleges fall into Clusters 1 and 3. Almost half of the private institutions of higher education and almost half of the small private liberal arts colleges fall into Cluster 1.

- Very few private institutions fall into Clusters 2 and 4, having significant proportions of revenues from endowment income or sponsored research. There are 44 private institutions in the "endowment" cluster and 33 in the "sponsored research" cluster.

- For all five clusters of institutions, student-aid expenditures per FTE student exceeded student-aid revenues per FTE student. In private institutions, expenditures exceeded revenues by 56%; in public institutions, expenditures exceeded revenues by 32%. The additional funds were channeled from other revenue sources.

- In the 673 institutions in Cluster 1 ("tuition-dependent"), student-aid expenditures exceeded student-aid revenues by an average of 167%.

- On a "per FTE student" basis, federal student-aid grant revenues constituted 37% of the total student-aid revenues of private institutions in 1972-73. In public institutions, these federal funds constituted 57% of total student-aid revenues.

- Small private liberal arts colleges:

1. Nearly half of the small private liberal arts colleges fall into Cluster 1 with high dependence on tuition revenue, and no sizeable annual giving, endowment income, or government appropriations. Approximately one-half are in Cluster 3 with significant revenue proportions from annual private giving. Only 13 small private liberal arts colleges fall into the cluster having a high proportion of endowment income.

2. Public policy can assist these institutions having great dependence on tuition and private giving by providing increased student aid at the federal and state level, and increased stimuli for private giving through the federal tax laws.

PURPOSE

This taxonomy of all institutions of higher education was developed as a tool for analyzing the patterns of current fund revenues and expenditures of institutions. The goal of this effort, as distinguished from other taxonomies, has been to analyze the entire range of current fund revenues and expenditures for all institutions simultaneously, examining them for the characteristics which have the greatest influence in distinguishing the institutions from each other; and then grouping the institutions together according to these similarities and differences.

The federal government has expressed concern for the financial condition of small private liberal arts colleges and interest in which steps might be considered to assist these colleges. The current emphasis seems to be focused on the delicate balance between revenues and expenditures that these institutions must maintain in order to insure the continuation of this segment of higher education. We have included all institutions of higher education in this taxonomy, however, because the significance of the financial characteristics of the small private liberal arts colleges is highlighted when they are compared to other private institutions as well as to the public sector. We did not initially separate institutions into any groups, either by control (public, private), or academic programs (2-yr., 4-yr., university; or Carnegie classification). Our concern was to examine existing financial patterns first, and then other characteristics as they related to the financial description.

Analysis of the financial difficulties of the private sector of higher education <u>en masse</u>, and consideration of public policies to address these difficulties as if private higher education were a monolith do not permit assessment of the varying degree of impact which different policies would have on different types of institutions. In addition, although those who routinely work with higher education data have a general sense of the dimensions and variety of revenue sources and

expenditure patterns among different types of institutions, these perceptions are difficult to communicate precisely and effectively to policy makers whose view of the entire private sector may be influenced by first-hand knowledge of a few institutions, or who may have primarily impressionistic perceptions of the private sector. A taxonomic approach based on empirical analysis can provide a framework for more precise analysis of the financial characteristics of the universe of institutions, and the impact of existing and proposed public policies toward higher education.

METHODOLOGY

Data Base

The data base selected was the 1972-73 Higher Education General Information Survey (HEGIS) financial tape which was the latest tape then available from the U. S. Office of Education, and the residence and migration tape for the same year, which supplies data on the numbers of students in a given institution who are classified as "in-state" versus "out-of-state". The data file created therefore included information for each institution on current fund revenues and expenditures, basic enrollment data, and the numbers of in-state vs. out-of-state students. Ratios of these data elements were then computed and added to the file, e.g., proportion which tuition and required fees constitutes of educational and general revenue (E & G), and the amount of tuition revenue per full-time-equivalent student (FTE). These tape files consequently created a statistical profile for each institution of higher education.

Analysis

Because of the complexity of the institutional statistical profiles, a principal components analysis was used to reduce a set of 53 financial indices to a smaller set of derived measures. The data used in the principal components analysis were the ratios of the data for each institution, that is, tuition as a percent of E & G revenue, not the aggregate amount of tuition revenue (see Attachment 2). The purpose of this decision was to avoid the obvious outcome that the amount of the revenues and the size of the institutions are the primary distinguishing factors.

Since the 53 variables introduced into the principal components analysis included the basic current fund institutional "cash flow" categories, they reflected outcomes of earlier public policy decisions in the form of state and federal appropriated funds received by institutions, as well as private giving stimulated in part by federal tax laws.

Once the institutional profiles had been "streamlined" by the principal components analysis, a cluster analysis was used to create the taxonomy. Cluster analysis is a method which groups objects (in this case, the institutions) according to their degree of similarity with one another. Thirty-two groups of institutions were produced containing the universe of 2809 institutions which reported data on the HEGIS finance tape.

RESULTS

Results of Principal Components Analysis

The principal components analysis indicated that the variables which had the greatest effect in distinguishing institutions from each other were variables related to sponsored research. The six sponsored research variables constituted "factor 1".

It is interesting that the second most influential group of variables (constituting factor 2) was a bipolar factor. The relatively high tuition revenues of private institutions and the relatively high state revenues of public institutions produced combined positive/negative scores that differentiated among institutions.

A series of student-aid ratios constituted the third most significant factor in differentiating among institutions. The other four of the seven factors contained key variables such as E & G revenues as a proportion of current fund revenues, endowment income, and annual private gifts as percents of E & G revenues, and state appropriations per FTE student (see Attachment 3).

It is significant that the key factors in distinguishing institutions from each other are primarily revenues, not expenditures. It is evident, therefore, that the key factors in distinguishing institutions of higher education from each other are either directly or indirectly related to public policy. Most sponsored research is federally funded, a significant portion of student aid is either federally or state funded, the federal tax laws are a major stimulus to the creation of endowments and to annual private giving, and state and/or local appropriations are the major source of support to public institutions.

Results of Cluster Analysis

The most obvious initial observations about the 32 groups were that almost all of the research institutions grouped together in separate groups, and that beyond that, public and private institutions separated themselves into different groups in the large majority of cases. Public institutions were concentrated in seven groups while private institutions revealed greater variation in financial characteristics by spreading among 21 groups. Four groups were mixed.

Apart from the groups containing the research institutions (public and private), one finds that the difference in "scores" between the groups containing public as opposed to private institutions is the score on factor 2, dealing with revenue sources. The negative score indicates a high percent of state appropriations as a proportion of E & G revenue. Conversely, the groups containing private institutions have positive scores, indicating relatively high dependence upon tuition. The other factors which distribute the private institutions into 21 groups (in contrast to the homogeneity of the public groups), are principally student aid, endowment income, and annual private giving.

Description of Clusters

To simplify analysis, all 32 groups of institutions can be consolidated into five basic clusters with the following major characteristics:

Cluster (1): Tuition is a high proportion (mean value: 78%) of educational and general revenue (E & G); revenues from endowment, annual private giving and sponsored research constitute low proportions. This cluster includes almost half (663) of all private institutions and almost half (319) of the small private liberal arts colleges (Carnegie code 3.1-3.2).

Cluster (2): Endowment Revenue is above the national average proportion of E & G revenue for all institutions (mean value: 48%). Tuition as a proportion of E & G, varies in this cluster from low to high; annual giving is a significant proportion but is not markedly above the average for the entire universe of institutions, whereas endowment income is. This cluster includes approximately 44 private institutions, of which 13 are small private liberal arts colleges.

Cluster (3): Revenue resulting from annual private giving is a significant percent of E & G revenue for this cluster (mean value: 34%) whereas endowment revenue is a low proportion and tuition is a low to moderate percentage. This cluster includes approximately one-half of the private institutions and one-half of the small private liberal arts colleges.

Cluster (4): Sponsored Research, primarily federal, constitutes a significant proportion of E & G revenues of these institutions (mean value: 27%), and there is wide variation among annual giving, endowment revenue, and state appropriations (the latter primarily for medical schools and public institutions). There are 49 institutions in this group, of which two-thirds are private.

Cluster (5): Government Appropriations as a proportion of E & G revenue are the predominant characteristic of this cluster (mean value: 69%). These are primarily state and local, not federal appropriations, and this cluster includes nearly all of the public institutions, 1259 (excluding principally the public research institutions).

SELECTED SOURCES OF EDUCATIONAL AND GENERAL REVENUES BY GROUPS OF INSTITUTIONS OF HIGHER EDUCATION

1972 - 73

	Tuition and Fees/ E & G Revenues	Endowment/ E & G Revenues	Private Giving/ E & G Revenues	Sponsored Research/ E & G Revenues	Governmental Appropriations/ E & G Revenues
Cluster 1: Tuition* (N = 673)	78 **	4%	9%	1%	2%
Cluster 2: Endowment* (N = 44)	20%	48%	25%	1%	1%
Cluster 3: Private Giving* (N = 722)	51%	3%	34%	0%	4%
Cluster 4: Sponsored Research* (N = 49)	27%	6%	6%	27%	17%
Cluster 5: Governmental Appropriations* (N = 1,321)	20%	0%	1%	2%	69%
All Institutions	40%	3%	11%	2%	33%
Public Institutions	18%	0%	0%	2%	66%
Private Institutions	61%	5%	21%	2%	3%

*Each cluster of institutions can be described by one primary variable within a factor.

**Institutions within Cluster 1 average 78 percent of their educational and general revenues from tuition and fee sources.

Sources: Policy Analysis Service, American Council on Education based on HEGIS data for 1972-73.

TABLE 2

DISTRIBUTION OF GROUPS OF INSTITUTIONS OF HIGHER EDUCATION
BY CONTROL
1972-73

		Percent Public	Percent Private
Cluster 1:	Tuition* (N = 673)	1%	99%
Cluster 2:	Endowment* (N = 44)	0%	100%
Cluster 3:	Private Giving* (N = 722)	2%	98%
Cluster 4:	Sponsored Research* (N = 49)	33%	67%
Cluster 5:	Governmental Appropriations* (N = 1,321)	95%	5%

*Each cluster of institutions can be described by one primary variable within a factor.

Sources: Policy Analysis Service, American Council on Education based on HEGIS data for 1972-73.

Conclusions

Cluster 1. From the characteristics of this cluster, it is apparent that approximately one-quarter of American higher education institutions (almost half of the private institutions of higher education, and almost half of the small private liberal arts colleges) are strongly tuition-dependent, and receive only modest revenues from other sources. That is, relative to their total E & G revenues, they do not rely substantially on endowment, on large amounts of annual private giving, on federal, state, or local appropriations. Their basic financial support is almost totally from students who choose to attend their institutions. This cluster contains seven of the original 32 clusters, only one of which receives as much as 30% of its revenues from sources other than tuition.

Cluster 2. This cluster of institutions with endowments of sufficient size to generate substantial revenues is small, comprising 44 institutions, 30% of which are small private liberal arts colleges. Even though institutions with sizeable endowments enjoy plural sources of revenue support and therefore have a distinct financial advantage, because of the limited return on market investments, these institutions must generate significant additional income through annual giving.

Cluster 3. A large group of institutions, comprising one-half of the private institutions, appear in Cluster 3; these institutions' financial profiles are characterized by a significant proportion of annual giving revenues.

This third cluster is described as a single entity to facilitate an overview of policy issues. More specific policy implications emerge when the cluster is broken down into smaller components. This cluster contains 10 of the original 32 clusters produced by the computer cluster analysis. These 10 clusters were collapsed by further computer analysis into three groups, which we then, for convenience, combined into one large group. The three groups have the following characteristics:

(1) The first contains the largest number of institutions, 568. These institutions receive a significant proportion of their revenues from private giving (mean values: 12-50%) in comparison to the "tuition-dependent" Cluster 1 described earlier, and they receive more student-aid revenues in proportion to their total current fund revenues than those "tuition-dependent" institutions, primarily because of greater student-aid revenues from private giving. Many of these institutions are church-related, and 33 are traditionally black colleges.

(2) The second group contains a smaller number of institutions, 115, which are also primarily church-related. These institutions receive a much higher percentage of their E & G revenues from private giving than other institutions (mean values: 68-80%).

(3) The third group of 39 institutions receives a lesser but still significant proportion of E & G revenues from private giving (mean values: 23-47%), but its additional distinctive characteristic is very high student-aid revenues relative to those of other institutions. For these, student-aid revenues constitute an average 17-26% of current fund revenues, whereas the average for all institutions is 3.6%. These institutions are again primarily church-related, and 18 are traditionally black colleges. The predominantly white institutions receive large amounts of student-aid revenues primarily from private giving, whereas the traditionally black institutions receive large amounts of federal student assistance.

The tuition income of these institutions in Cluster 3 is thus supplemented by an additional source of revenue, and the tuition collected per FTE tends to be consequently lower than that of the institutions in Cluster 1; however, Clusters 1 and 3 rely heavily on annual support from either students, or students and alumni. These institutions do not enjoy a variety of revenue sources to help protect them from cyclical adverse economic circumstances which result in increased operating costs, student inability to pay rising tuition rates, and alumni inability to increase giving to compensate for cost increases.

Cluster 4. The fourth cluster, characterized by sponsored research revenues as a significant portion of E & G revenues, is small, comprising only 49 institutions, of which 33 are private. These institutions have very specialized problems, in contrast to the rest of the academic universe, in maintaining and refining their research capacity as a national resource, while concurrently educating undergraduates, and undertaking specific projects for the federal government and other sponsors. Their financial needs should receive specialized analysis beyond the scope of this report. Excluding the medical schools, public and private institutions fall into separate subgroups within this cluster. The medical schools and other institutions in the cluster, predominantly public, averaged 18% of their E & G revenues from sponsored research. The public institutions' other significant revenue source is predictably state appropriations. Private institutions divide themselves into those which have significant endowment and annual giving, and those which do not. Only nine private institutions in this cluster characterized by sponsored research had combined endowment/giving revenues averaging 30% or more of their E & G budgets. Apart from these few institutions, the private institutions engaged in the nation's research effort are primarily dependent on a combination of sponsored research and tuition revenues. Any significant diminution therefore of federal research appropriations would have marked impact on these institutions' finances.

Cluster 5. The last cluster, number 5, in which state and local government appropriations are the predominant characteristics, reflects a diminished proportion of tuition in E & G revenues. For these public institutions, tuition averaged only 20% of E & G revenues, whereas government appropriations constituted 69%.

Distribution of Types of Institutions

Universities, four-year colleges, and two-year colleges are distributed widely through all the five clusters.

The Carnegie classification of institutions of higher education classifies institutions by academic program:

Type of Institution	Carnegie Class Number	Number of Institutions
Research and Doctoral Granting Institutions	1	177
Comprehensive Institutions	2	471
Liberal Arts Colleges	3	726
Two-year Colleges	4	1095
Specialized Institutions (seminaries, engineering and art schools)	5	443

There is only limited correlation between these categories and this taxonomy based on current fund revenues and expenditures. Cluster 1, for example, with its high reliance on tuition revenues, contains substantial numbers from all five Carnegie classes. And Cluster 5, with its high percentage of revenue from sponsored research has significant representation from Carnegie classes 1, 2, and 5.

Thus the financial profiles of institutions in terms of ratios do not correspond closely to the traditional classifications and groupings of institutions with the notable exception of the public-private dichotomy.

Institutional Characteristics

Institutions with Enrollments under 1,000. In our data-base universe of 2809 institutions, there are approximately 1,100 institutions with head count enrollments under 1,000. These are predominantly private and are concentrated in Cluster 1 (the "tuition" cluster) and Cluster 3 (the "private giving" cluster).

Single Sex Institutions. Single sex institutions are concentrated primarily in Cluster 1 (the "tuition" cluster) and Cluster 3 (the "private giving" cluster).

In-State vs. Out-of-State Students. The cluster with the highest average percentage of in-state students (87%) is Cluster 5 which is characterized by state appropriations as a major revenue source and contains the majority of public institutions. The clusters with the next highest percentages of in-state students are the "private giving" and "sponsored research" clusters, each averaging 66% and 58%, respectively, and the "endowment" cluster with 46%.

TABLE 3

INSTITUTIONAL CHARACTERISTICS OF GROUPS OF INSTITUTIONS OF HIGHER EDUCATION

1972-73

	Percent with 3.1 or 3.2 Carnegie Codes	Percent with enrollment of less than 1,000	Percent with single-sex institutions	Percent in-state students
Cluster 1: Tuition* (N = 673)	47%	49%	14%	56%**
Cluster 2: Endowment* (N = 44)	30%	89%	18%	46%
Cluster 3: Private Giving* (N = 722)	46%	77%	21%	66%
Cluster 4: Sponsored Research* (N = 49)	0%	41%	2%	58%
Cluster 5: Governmental Appropriations* (N = 1,321)	1%	17%	1%	87%
All Institutions	23%	44%	9%	74%
Public Institutions	NA	19%	1%	88%
Private Institutions	NA	64%	17%	61%

*Each cluster of institutions can be described by one primary variable within a factor.

**Institutions within Cluster 1 average 56 percent of their students from within the home state.

Sources: Policy Analysis Service, American Council on Education based on HEGIS data for 1972-73.

Student Aid

The two most notable aspects of the distribution of student aid among the five clusters of institutions are the amounts of federal student aid and the size of the gap between student-aid revenues and expenditures.

Federal Student Aid. The federal student aid grant amounts recorded by the institutions on the 1972-73 HEGIS questionnaire included any federal student assistance received which was classified as a grant and involved no work or service. Over half these grants, as recorded by the institutions, were awarded under one federal need-based undergraduate program. The rest of these grant funds were awarded for graduate or undergraduate study by a variety of agencies and programs, though the National Center for Educational Statistics informally estimates that a significant percentage of the remainder were probably at least partially need-based. (Source: telephone conversation in Jan. 1976 with Norman Brandt of NCES.)

During the academic year 1972-73, the major federal need-based student aid grant program in operation was the Educational Opportunity Grant (EOG) program; since that time federal student assistance has increased in importance with the introduction of the more comprehensive Basic Educational Opportunity Program. The EOG, however, and its successor, the Supplemental Education Grant (SEOG), are administered by institutions in contrast to the BEOG program, and the EOG/SEOG grant funds appear in the HEGIS revenues/expenditures statistics for each institution whereas BEOG funds do not. Even though EOG funds did not represent all federal student aid grant funds, and even though the criteria for institution awards have changed slightly since 1972-73, the relative distribution of federal student aid grant funds at that time is a useful rough index from which one can judge the likelihood that various groups of institutions will receive federal need-based aid in the future.

As noted previously, the principal components analysis identified student aid as the third most significant factor in differentiating among institutions. The factor is however made up of six variables, and federal student aid grant revenues per FTE student is only the 4th of these six in statistical significance.

From the institutional point of view, a major consideration is the proportion which the federal EOG program constituted in 1972-73 of the total student-aid revenues of the institutions. For all institutions, public and private, federal student-aid grant revenues averaged 41% of the institutions' total student-aid revenues per FTE student--for public institutions, the national average was 57%, and for private institutions federal aid accounted for 37% of the per-student revenues. Other sources of student-aid revenues are, of course, endowment income, private giving, and state and local appropriations which have been designated for student assistance purposes.

Of the 673 institutions in Cluster 1 ("tuition-dependent"), almost one-half received federal student assistance grant revenues which averaged only 18% of their total student-aid revenues per FTE student, as opposed to the national average for private institutions of 37%. Since aid to students may reenter institutions' accounts as tuition revenues, those institutions heavily dependent on tuition have a strong concern for student-aid revenue. In spite of this tuition dependence, the institutions mentioned above not only received a relatively low proportion of their student-aid revenues from the federal government, but also received relatively low student-aid revenues from all sources.

Cluster 3 ("private giving") contains not only many church-related institutions but many religious seminaries; for several subgroups within this cluster, therefore, federal student aid constitutes a very low proportion of total student-aid revenues; since seminaries are graduate institutions, their students are not eligible for EOG/SEOG awards. These subgroups, as well as the institutions in

Cluster 2 (with large endowments), receive significant proportions of their student aid from private giving and endowment income, respectively.

Cluster 3 contains, however, not only these subgroups receiving low proportions of federal student aid, but also several subgroups receiving substantial amounts of federal student aid; these subgroups contain several private traditionally black colleges which are also often church-related. For example, the national average of federal student-aid grant revenue per FTE student in private institutions was $65; in contrast, institutions in one subgroup under Cluster 3 averaged $671 per FTE student, and federal grants comprised 72% of that subgroup's student-aid revenues. Ten out of the 17 institutions in this subgroup are traditionally black colleges. This subgroup also received a substantial amount of student aid from private giving; however, it should be noted that the low-income levels of a high proportion of students in the traditionally black colleges necessitate large amounts of student aid to enable the students to attend and to pay the tuition.

To assist these students in meeting this need, public and private black colleges in 1974-75 received 6.8% of the Office of Education need-based student aid (BEOG, SEOG, CWS, NDSL)--over $100 million. Their own institutional resources are meager, in comparison; only 1% of the tuition remissions and waivers were given at the black colleges. Federal student aid is thus a vital source of student aid for the traditionally black institutions. (Source: 1975 survey of student aid, by the ACE Higher Education Panel, funded by USOE.)

Student Aid Deficit. Many institutions channel educational and general revenues to student-aid expenditures; for all five clusters of institutions, student-aid expenditures per FTE student exceed student-aid revenues per FTE student. The national average proportion by which student-aid expenditures per FTE student exceeded student-aid revenues per FTE student in 1972-73 was 50% For private institutions the average was 56%, and for public institutions, 32%.

The 673 institutions in Cluster 1 were dependent on tuition revenue for 78% of their E & G; yet this group of institutions spent, on an average 167% more per FTE student for student aid than they received in student-aid revenues.

Policy Implications of Student-Aid Deficits. The group of 673 institutions in Cluster 1, as mentioned before, comprises almost a quarter of American higher education and almost half of private higher education institutions. They educate predominantly in-state students but a significant proportion of their students come from other states. Since they do not have significant revenue sources other than tuition, all external student-aid funds, even if grossly inadequate, are important to the institutions. If the existing external student-aid funds were reduced, the 167% student-aid deficit would rise, cutting further into educational revenues. For schools with enrollment under 1,000, any student-aid reductions would be particularly traumatic, since any reduction which caused enrollment decreases would have even greater revenue impact on a small institution than on a larger institution. Increases in student aid, whether from federal, state, or private sources, would at least bring these institutions closer to the national average student-aid deficit.

TABLE 4

STUDEN. AID CHARACTERISTICS OF GROUPS OF INSTITUTIONS OF H. HER EDUCATION

1972-73

	Percent Difference Between Total Student Aid Revenues and Expenditures per FTE	Federal Student Aid Revenues per FTE/ Total Student Aid Revenues per FTE
Cluster 1: Tuition* (N = 673)	167%**	35%
Cluster 2: Endowment* (N = 44)	22%	5%
Cluster 3: Private Giving* (N = 722)	63%	37%
Cluster 4: Sponsored Research* (N = 49)	113%	30%
Cluster 5: Governmental Appropriations* (N = 1,321)	19%	56%
All Institutions	50%	41%
Public Institutions	32%	57%
Private Institutions	56%	37%

*Each cluster of institutions can be described by one primary variable within a factor.

**Institutions within Cluster 1 spend 167% more per FTE in student aid than they receive.

Sources: Policy Analysis Service, American Council on Education based on HEGIS data for 1972-73.

Small Private Liberal Arts Colleges

In response to President Ford's particular interest in the small private liberal arts college, the following points pertain to those institutions falling into Carnegie code 3.1 and 3.2:

1. Nearly half the almost 700 small private liberal arts colleges fall into Cluster 1 characterized by tuition revenue as an average 78% percentage of the E & G revenues of the institutions, with no sizeable annual giving, endowment income, or governmenc appropriations compared to other institutions. Institutions in this cluster spend an average of 167% more on student aid than they receive in student-aid revenues.

2. Over one-half of them fall into the cluster receiving an average of 34% of their E & G revenues from annual private giving, thereby having lower dependence on tuition but no significant endowment income.

3. Only 13 institutions fall into the cluster having significant endowment income.

4. The ACE/UCLA sample survey of first-time full-time freshmen for 1974 indicated that, in the majority of small private liberal arts colleges, 27% of the first-time full-time freshmen came from families making less than $10,000. Thus these colleges have substantial proportions of students from families for which the high tuition necessary in these institutions having no public subsidy is a hardship if not an impossibility.

Policy Implications for the Small Liberal Arts Colleges

Approximately one-half of these had head count enrollments of 1,000 and under; the great majority have enrollments under 2,500. Recent case studies indicate that support costs per student are higher for those institutions with approximate enrollments of 1,000 than those with 2,500. (Parker, Norman A. A Study of the Support Operations of Independent Liberal Arts Colleges. Academy for Educational Development, 1975.) Thus the smaller institutions are already under an inherent financial disadvantage regarding support costs because of their small size. It is doubtful that they can generate greater annual giving revenues without adding staff and further increasing these support costs. Howard Bowen notes that private giving revenues have increased more than total revenues between 1971 and 1974 but that this trend may be a sign of weakness. "It means that institutions were required to carry on constant campaigns for current support at a heavy cost in administrative time and energy, and it means that gifts which in better times would have been added to endowment or invested in plant were now spent to balance the operating budget." (Bowen, Howard R. and W. John Minter. Private Higher Education, First Annual Report on ..., Washington, Association of American Colleges, 1975.)

A small institution, therefore, dependent on tuition or a combination of tuition and private giving, needs student aid and tax incentives which will reinforce its recruiting and fund-raising efforts. Intensification of these efforts will not substitute for this external help.

Increases in student-aid revenues, to assist students in paying higher tuition resulting from inflation, could come from federal, state or private sources. Institutions already receiving significant percentages of their student aid revenues from private giving may have an advantage in tapping those sources further, but with inflation/recession trends affecting personal spending, one cannot assume this.

Those institutions which are strongly tuition-dependent have even greater need for new stimuli from public policy to increase student-aid revenues; the range of options includes federal and state increased appropriations, changes in federal and state programs to cover a broader student income spectrum, and modifications in federal tax laws to stimulate giving from a broader segment of society.

Future Action

The Policy Analysis Service has summarized the nature of the clusters for public policy purposes, with special attention to the small private liberal arts colleges. We will, in addition, after the completion of this contract, be performing further analysis on these clusters to examine in greater depth their financial and various academic characteristics. We will keep the U. S. Office of Education advised of the results of this analysis directed toward a greater comprehension of the relationship between institutional sources of support, public policy, and academic programs.

Since computer programs have been developed in the course of this contract which will perform cluster analysis on the universe of higher education institutions, it is possible for policy analysts and researchers to perform the same type of analysis which was done under this contract using more recent data or completely different variables. The applications of cluster analysis are not limited to financial data since any data on the institutions could be processed by these programs. The cluster analysis computer programs were written to run on a Xerox computer, but within two months ACE will have made the slight modifications necessary for it to run on an IBM 370, and we will make listings of the programs available to those interested; we will also supply listings of the present programs as part of the final report of this contract and listings of the programs as modified to run on an IBM 370 computer after we have completed that work.

Because of the changing nature of the HEGIS questionnaire, and the extensive changes made for the Fiscal Year 1975 questionnaire, it is not possible to repeat this same cluster analysis with completely comparable data except for Fiscal Years 1971-74. There are, however, sufficient similarities between data collected in the

HEGIS system from year to year to make subsequent analyses like this one relevant, particularly on revenue sources (tuition, private giving, endoment income, government appropriations). The new categories introduced in FY 75 differentiating restricted from unrestricted funds for these various revenue sources may provide useful new distinctions and insights into institutional finance.

TECHNICAL APPENDIX

Principal Components Analysis

Existing taxonomies of institutions of higher education are primarily *a priori* classification schemes which were constructed rationally. We desired an empirical taxonomy, *i.e.*, one which rises through the systematic evaluation of data collected about each institution. Because of the complexity of the institutional statistical profiles, principal components analysis was used to reduce the set of over fifty financial indices to a smaller set of derived measures. Once this was done, each institution could be represented by, for example, half a dozen measures by factor-scoring each institution in terms of the new measures.

The data used in the principal components analysis were the ratios of the data for each institution, that is, tuition as a proportion of E & G revenue, not the aggregate amount of tuition revenue. A generalized software package--Statistical Package for the Social Sciences--was used to develop the necessary computer runs.

Results of Principal Components Analysis

The principal components analysis produced a list of the 14 factors accounting for 78% of the variance among institutions. These 14 principal components were rotated using the normalized varimax rotation method and the seven largest rotated factors were chosen for the next step in the development of the taxonomy. The analysis had revealed that these seven factors accounted for 57% of the cumulative variance.

The principal components analysis indicated that the variables which had the greatest effect in distinguishing institutions from each other were variables related to sponsored research. The six sponsored research variables constituted "factor 1", and each institution was rated on the extent to which it is differentiated from other institutions in terms of this characteristic. "Factor 1" accounted for 18% of the variance among institutions.

It is interesting that the second most influential group of variables, constituting factor 2, was a bipolar factor relating to income derived from tuition vs. state appropriation sources. The statistical influence of these sources of income scores in differentiating among institutions was second only to sponsored research, and accounted for 14.5% of the variance.

A series of student-aid ratios constituted the third most significant factor in differentiating among institutions (6.6% of the variance); the variables having the most influence in an institution's score were ratios of total student aid from all sources, e.g., total student aid as a proportion of total current fund revenues (not E & G revenues, since student-aid revenues are separate from E & G revenues in HEGIS). Federal student-aid revenue per FTE was 1 of the 5 variables making up this factor, but not the most dominant one, and therefore not having as much weight in distinguishing among institutions as several of the others in the factor.

The other four of the seven factors contained key variables such as E & G revenue as a proportion of current fund revenues, endowment income and annual private giving as percents of E & G revenue, and state appropriations per FTE student.

Methodology for Creation of 32 Clusters.

In addition to the earlier discussion of the factor analysis and cluster analysis, the following points are noted for those interested in the process.

There are many clustering techniques, but only one, the so-called K-means analysis, will allow the clustering of the large number of schools in our population. This technique, however, requires the analyst to specify the number of clusters in advance. Since we had no clear idea of how many clusters would be specified, it was decided to employ one of the other clustering methods with a random sample of schools in order to arrive at some estimate of the number of clusters.

The method chosen for this preliminary clustering was a hierarchial method developed by Ward. (Ward, J. H., Jr. Hierarchial grouping to optimize an objective function. Journal of the American Statistical Association, 58: 236-244, 1963.) This technique begins by considering each institution as a cluster of one, and by using a distance measure of similarity, it seeks those two institutions the profiles of which are most similar, placing them into the same cluster. After the number of clusters has been reduced by one, the two most similar remaining clusters are collapsed, this collapsing process continuing until all schools are in one cluster. Thus, a logical hierarchy or tree of clusters is produced, and the only decision facing the investigator concerns the question of which level of the hierarchy to use. Obviously, one would wish to choose a level containing fewer clusters than institutions, but certainly one containing more than one cluster. This decision is facilitated by using an error function which gives an indication of how homogeneous the clusters are; as the number of clusters decrease they become more heterogeneous. At some level of the hierarchy this error function typically

shows a steep rise, and it is usual for the investigator to select that level immediately preceding this jump. Thus, the hierarchial technique was used with a random sample of institutions to secure an estimate of the number of clusters to be used in the final state of the analysis.

The final taxonomy of the entire population of institutions into 32 clusters was achieved by using the K-means method. This technique requires not only the prior specification of the number of clusters, but also, for each cluster desired, a preliminary or trial profile. The average cluster profiles or centroids are computed and the classification repeated. Invariably there is some shifting of cluster memberships, so the process is repeated until the cluster memberships and centroids stabilize to become the final taxonomy. We then have a mutually exclusive and exhaustive taxonomy of institutions. The typical member of each cluster is identified by the average factor profile for that cluster.

This description of the methodology has been adapted from material supplied by Dr. Charles E. Rice, Associate Professor of Psychology, George Washington University, under whose guidance the taxonomy was developed. The computer program for the hierarchial grouping, including interinstitutional distances, was a modification of a program supplied by Dr. Rice. A K-means clustering program handling 3,000 institutions was developed by staff of the ACE Division of Educational Statistics under the direction of Dr. John A. Creager and Clay Henderson.

Methodology for the Collapse of 32 Clusters to 5

We produced in this taxonomy 32 clusters of institutions to insure adequate differentiation between types of institutions. For the purpose of this report we have collapsed these 32 clusters into 5 "super clusters" in order to summarize the policy implications. This collapsing process involved both computer analysis and human judgment. The computer-based phase of this reduction involved the use, once again, of the hierarchical method. The 32 cluster centroids, derived from the K-means analysis, were subjected to this taxonomic routine producing the fewer numbers of collapsed clusters.

This final computer-produced grouping which we used as our base consisted of 9 clusters. Three are identical to three of our five "super clusters", number 5 ("state appropriations"), 2 ("endowment") and 1 ("tuition"). We created our cluster 3 ("private giving") by combining three clusters produced by the computer. One was a large group characterized by private giving as a significant proportion of E & G revenues, in another smaller group, private giving was an extremely high proportion, and in the third, student-aid income from private giving and federal sources was a high proportion.

We created our Cluster 4 from the remaining three clusters which were all characterized by sponsored research as a significant proportion of E & G revenues. These three computer-produced clusters contained only 49 institutions and had remained separate even from each other, indicating the great difference not only between research-oriented institutions and the rest of higher education, but among research institutions themselves.

ATTACHMENT 1

FACTORS WHICH DIFFERENTIATE AMONG ALL INSTITUTIONS,

RANKED IN ORDER OF SIGNIFICANCE

Ranking	Cumulative Percent of Variance	Factor Label
1	18%	Sponsored research
2	33%	Sources of revenues and migration patterns of students(bipolar)
3	40%	Student aid
4	43%	Revenues and expenditures for educational and general purposes
5	49%	Endowment income
6	53%	Income from private gifts and expenditures for libraries
7	58%	State appropriations and expenditures for administration

ATTACHMENT 2

SELECTED VARIABLES FROM THE HEGIS FINANCIAL STATISTICS SURVEYS FOR 1972-73

USED IN THE PRINCIPAL COMPONENTS ANALYSIS

Revenues

Mean Values for Types of Institutions			
Total	Public	Private	Variable Name
78.3%	81.3%	75.6%	Educational and General Revenues / Total Current Funds - Grand Total
3.6%	2.5%	4.7%	Student Aid Grants - Total / Total Current Funds Revenues - Grand Total
.8%	.7%	.9%	Major Service Programs / Total Current Funds Revenues - Grand Total
40.2%	17.5%	60.9%	Tuition and Fees / Educational and General Revenues - Total
33.4%	66.3%	3.2%	Governmental Appropriations - Total / Educational and General Revenues - Total
2.8%	3.6%	2.1%	Governmental Appropriations - Federal Government / Educational and General Revenues - Total
24.4%	49.9%	1.1%	Governmental Appropriations - State Government / Educational and General Revenues - Total
2.6%	.1%	4.8%	Endowment Income / Educational and General Revenues - Total
11.2%	.3%	21.1%	Private Gifts / Educational and General Revenues - Total
1.6%	1.6%	1.5%	Sponsored Research - Total / Educational and General Revenues - Total
1.2%	1.3%	1.1%	Sponsored Research - Federal Government / Educational and General Revenues - Total
.3%	.2%	.3%	Sponsored Research - Nongovernmental / Educational and General Revenues - Total
2.6%	3.4%	2.0%	Other Sponsored Programs - Federal Government / Educational and General Revenues - Total
42.2%	51.0%	34.0%	Student Aid Grants - Federal Government / Student Aid Grants - Total
10.8%	13.8%	8.0%	Student Aid Grants - State Government / Student Aid Grants - Total
18.3%	13.6%	22.7%	Student Aid Grants - Private Gifts and Grants / Student Aid Grants - Total

Types of Institutions			
Total	Public	Private	Variable Name
6.7%	1.6%	11.4%	Student Aid Grants - Endowment Income / Student Aid Grants - Total
1.9%	2.5%	1.4%	Major Service Programs - Hospitals / Major Service Programs - Total
49.4%	32.5%	65.0%	Auxiliary Enterprises - Housing and Food Services / Auxiliary Enterprises - Total
Expenditures			
77.2%	80.8%	73.9%	Educational and General Expenditures - Total / Current Funds Expenditures - Grand Total
5.2%	3.0%	7.3%	Student Aid Grants / Current Funds Expenditures - Grand Total
.8%	.8%	.9%	Major Service Programs - Total / Current Funds Expenditures - Grand Total
46.6%	50.2%	43.3%	Instruction and Departmental Research / Educational and General Expenditures - Total
1.5%	1.3%	1.6%	Organized Activities Related to Educational Departments / Educational and General Expenditures - Total
1.6%	1.7%	1.6%	Sponsored Research / Educational and General Expenditures - Total
3.2%	4.2%	2.2%	Other Sponsored Programs / Educational and General Expenditures - Total
4.8%	4.4%	5.2%	Libraries / Educational and General Expenditures - Total
12.0%	10.6%	13.4%	Physical Plant Maintenance and Operation / Educational and General Expenditures - Total
25.0%	18.4%	31.0%	Other Educational and General / Educational and General Expenditures - Total
1.9%	2.5%	1.4%	Major Service Programs - Other Service Programs / Major Service Programs - Total
48.5%	32.0%	63.6%	Auxiliary Enterprises - Housing and Food Services / Auxiliary Enterprises - Total

SELECTED VARIABLES FROM THE HEGIS RESIDENCE AND MIGRATION SURVEY FOR FALL 1972

USED IN PRINCIPAL COMPONENTS ANALYSIS

Mean Values for Types of Institutions			
Total	Public	Private	Variable
73.8%	88.1%	60.7%	Total In-state Students / Total Students
20.0%	4.8%	34.0%	Total Out-of-state Students / Total Students

Note: Residence and migration data are only available on students who were enrolled in resident degree-credit programs. Therefore, the ratios formed from the two variables listed above will not apply to students enrolled in extension degree-credit programs or in resident and extension non-degree-credit programs.

SELECTED VARIABLES FROM THE HEGIS FINANCIAL STATISTICS AND OPENING FALL ENROLLMENT SURVEYS

FOR 1972 - 73 USED IN PRINCIPAL COMPONENTS ANALYSIS

Revenues

Mean Values for Types of Institutions			
Total	Public	Private	Variable
$871	$ 291	$1,402	Tuition and Fees / Total Students - Full-time Equivalent
$622	$1,144	$ 144	Government Appropriations - Total / Total Students - Full-time Equivalent
$ 72	$ 65	$ 77	Government Appropriations - Federal Government / Total Students - Full-time Equivalent
$475	$ 924	$ 64	Government Appropriations - State Government / Total Students - Full-time Equivalent
$103	$ 12	$ 187	Endowment Income / Total Students - Full-time Equivalent
$340	$ 17	$ 636	Private Gifts / Total Students - Full-time Equivalent
$120	$ 128	$ 112	Sponsored Research - Total / Total Students - Full-time Equivalent
$105	$ 109	$ 102	Sponsored Research - Federal Government / Total Students - Full-time Equivalent
$ 27	$ 19	$ 35	Sponsored Research - Nongovernmental / Total Students - Full-time Equivalent

Types of Institutions			
Total	Public	Private	Variable
$120	$ 56	$ 178	Student Aid Grants - Total / Total Students - Full-time Equivalent
$ 49	$ 32	$ 65	Student Aid Grants - Federal Government / Total Students - Full-time Equivalent
$ 16	$ 13	$ 19	Student Aid Grants - State Government / Total Students - Full-time Equivalent
$ 28	$ 8	$ 46	Student Aid Grants - Private Gifts and Grants / Total Students - Full-time Equivalent
$ 16	$ 1	$ 29	Student Aid Grants - Endowment Income / Total Students - Full-time Equivalent
Expenditures			
$991	$ 859	$1,112	Instruction and Departmental Research / Total Students - Full-time Equivalent
$118	$ 127	$ 109	Sponsored Research / Total Students - Full-time Equivalent
$117	$ 82	$ 149	Libraries / Total Students - Full-time Equivalent
$300	$ 203	$ 389	Physical Plant Maintenance and Operation / Total Students - Full-time Equivalent
$573	$ 336	$ 790	Other Educational and General / Total Students - Full-time Equivalent
$180	$ 74	$ 277	Student Aid Grants / Total Students - Full-time Equivalent

ATTACHMENT 3

Factor 1 Sponsored Research

Variables: *Sponsored Research - Total / Educational and General Revenues - Total

*Sponsored Research - Federal Government / Educational and General Revenues - Total

*Sponsored Research / Educational and General Expenditures - Total

Sponsored Research - Total (Revenues) / Total Students - Full-time Equivalent

Sponsored Research - Federal Government (Revenues) / Total Students - Full-time Equivalent

Sponsored Research (Expenditures) / Total Students - Full-time Equivalent

Factor 2 Income from Tuition vs. State Appropriations (bipolar)

Variables: Total In-state Students / Total Students

Governmental Appropriations - Total / Educational and General Revenues - Total

Governmental Appropriations - State Government / Educational and General Revenues - Total

Total Out-of-state Students / Total Students

*Tuition and Fees / Educational and General Revenues - Total

Other Educational and General / Educational and General Expenditures - Total

Tuition and Fees / Total Students - Full-time Equivalent

Factor 3 Student Aid

Variables: *Student Aid Grants - Total / Total Current Funds Revenues - Grand Total

Student Aid Grants / Current Funds Expenditures - Grand Total

Student Aid Grants - Total (Revenues) / Total Students - Full-time Equivalent

Student Aid Grants - Federal Government (Revenues) / Total Students - FT

Student Aid Grants (Expenditures) / Total Students - Full-time Equivalen

*Variables which were most heavily weighted by the principal components analysis.

Factor 4 Revenues and Expenditures for Educational and General Purposes

Variables: *Educational and General Revenues / Total Current Funds Revenues - Grand Total

Educational and General Expenditures - Total / Current Funds Expenditures - Grand Total

Instruction and Departmental Research / Educational and General Expenditures - Total

Factor 5 Endowment Income

Variables: *Endowment Income / Educational and General Revenues - Total

Student Aid Grants - Endowment Income (Revenues) / Student Aid Grants - Total

Endowment Income / Total Students - Full-time Equivalent

Student Aid Grants - Endowment Income / Total Students - Full-time Equivalent

Factor 6 Income from Private Gifts and Expenditures for Libraries

Variables: *Private Gifts / Educational and General Revenues - Total

Libraries / Educational and General Expenditures - Total

Private Gifts / Total Students - Full-time Equivalent

Libraries / Total Students - Full-time Equivalent

Factor 7 State Appropriations and Expenditures for Administration

Variables: Government Appropriations - Total / Total Students - Full-time Equivalent

*Government Appropriations - State Government / Total Students - Full-time Equivalent

Other Educational and General (Expenditures) / Total Students - Full-time Equivalent

*Variables which were most heavily weighted by the principal components analysis.